and relatively dry air were applied to opposite ends, a polar growth resulted with reference to these conditions only and not with reference to what had been basal or apical in the twig before separation from the tree. Apparently, possible leaves failed to be formed in water without much air and possible roots failed to be formed in air without much moisture.

In many of the above experiments twigs of an undetermined native willow were used in the bundles with weeping willow and without different results. The assumption that the weeping willow has acquired these innumerable centers of new growth as a means to produce new trees when branches happen to be broken off, may not be in the line of fundamental explanations to be sought for.

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NOTES ON SOME SOUTHERN ILLINOIS PLANTS. — III

By H. A. Gleason

The two species of *Jussiaea* which extend into Illinois, *J. diffusa* Forsk. and *J. decurrens* (Walt.) DC., are of characteristically austro-riparian habit, and are always found in swamps or along streams. The former species is well distributed along the Mississippi on muddy banks with a gradual slope, and is able to live farther down the bank towards the water than any other plant except *Eragrostis hypnoides*. It is nowhere common and has so far not been observed except along the river. *Jussiaea decurrens*, on the other hand, is not found on the Mississippi side, but only along the Ohio River and its tributaries. It is very abundant among the Tertiary hills in Massac and Pulaski counties, and along the small streams flowing southward through the Carboniferous and Devonian regions in Pope and Hardin counties. The limited amount of field work done north of the Ozark uplift has not as yet revealed its presence there.

Jussiaea decurrens is of some interest because of the development of aërenchyma upon its subaquatic roots. This peculiarity

is found in a number of species of the genus and has been described by Schenck and others. Two types of aërenchyma formation may be recognized, depending on whether the plant grows in water or soil. In the latter case, the roots branch irregularly and extend downward into the soil. Some or all of them below the level of the ground-water are surrounded with a relatively thin layer of aërenchyma, which is easily torn off by pulling up the plant. The portion of the roots above the ground-water level are not so covered, unless the level has recently lowered. The plant usually grows in sand close to streams, where the water level is seldom more than one or two decimeters below the surface. When, as sometimes occurs, it grows along small muddy ditches, but with the water level beyond the reach of the roots, no aërenchyma is formed. It may be found growing also in shallow running water to a depth of two decimeters, and it is in such places that the aërenchyma is most richly developed. A number of roots radiate in fairly straight lines from the base of the stem, either upon or just below the surface of the soil, and extend a meter or more in length. At intervals along them are given off straight unbranched pneumatophores which grow vertically toward the surface of the water. Their diameter is small, about one millimeter, but they are thickly covered with aërenchyma so that the whole has a size of four to six millimeters. Their growth stops when they touch the surface of the water, but apparently may be resumed if the water rises. When the water falls the tips float with the current on the surface. New ones are constantly growing up and a well-grown plant may be surrounded by fifty or more of various lengths and ages. There are fewer of them on the roots which grow into shallower water, and when, as frequently happens, the plant grows just at the margin of the water the root system will show both types. The necessity of some such aërating device is very apparent in stagnant water but hardly evident for running streams.

In 1899 Dr. MacDougal delivered a lecture at Wood's Holl* on the influence of inversions of temperature on the distribution

* Biological Lectures from the Marine Biological Laboratory of Wood's Holl 1899 : 37–47. 1900.

of plants, in which he showed that the northernmost limits of southern species might be expected on hill tops, other things being equal, and the southernmost limits of northern species in the valleys. By inversion of temperature is meant the cooling at night of the lower layers of air by conduction to the soil, so that they reach a temperature some degrees below that of the upper strata. In a hilly or broken country this cold air settles by its greater weight into the valleys and the hill tops are covered with a constant supply of warmer air, with the result that their average temperature is higher and extremes less marked than in the valleys below.

There are a number of facts connected with plant distribution which help substantiate this claim, and it would seem that inversions of temperature are of considerable importance in such a broken country as the Ozark region of Southern Illinois. Bald Knob, in Union County, is a somewhat conical hill, rising over 150 meters above the surrounding valleys, and nearly 100 meters above the general level of the country. Its total height is just 300 meters. The farmer who cultivates what little arable land there is on its summit is able to market his tomatoes some days before his neighbors and never loses his crop by late frosts in the spring. The first frosts in autumn are also two to three weeks later than in the surrounding country. The general effect of this condition on the native flora is seen all through the southern end of the state, where the southern flora, two or three hundred species of which occur, is found almost exclusively either on the highest and driest uplands or in the swamps. The former situation is probably due to a temperature relation, the plants finding there a temperature more nearly like that farther south, which in a measure compensates for the unfavorable soil. The latter situation, in the swamps, is due to a water relation, which being near the optimum, permits the growth of southern species in spite of the lower temperatures.

The distribution of the yellow pine, *Pinus echinata*, which here reaches its northernmost limit in the Mississippi Valley, may be taken as an example. It is confined to a few steep-sided narrow-topped ridges from 80 to 120 meters high, where the influence

of temperature inversions must be very marked. More interesting, however, is the behavior of certain species normally members of the swamp associations, which here are near or at their northern limits. They are *Rhamnus caroliniana*, *Adelia acuminata*, *Celtis mississippiensis*, *Planera aquatica*, and *Ilex decidua*. Of these all but *Planera* are abundant in the swamps along the Mississippi River bayous, and to some extent also in the cypress swamps along the Ohio River. But they occur also on the dry rocky sides and tops of certain hills in Jackson County, 50 meters or more above the bottoms, where the soil is a thin clay and the forest cover very loose. The appearance of these plants associated with such xerophytes as *Ulmus alata*, *Sassafras Sassafras* and *Rhus aromatica*, and surrounded by tufts of *Agave virginica*, *Solidago Drummondii* and *Pellaea atropurpurea* is *bizarre* in the extreme. *Liquidambar styraciflua*, which in Illinois is confined to the southern part, shows indications of the same distribution. It is abundant on the driest uplands and in the swamps, but infrequent in the mesophytic midlands. The small cane, *Arundinaria tecta*, which is abundant in all the bottom-land swamps, wet woods and along streams, is also occasional in the moister upland woods and even in the thin but moist soil-deposits on ledges of shaded cliffs. It is worthy of note that in 1902 the canes in the latter habitat bloomed, though apparently no others did.

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GRAYIA OR EREMOSEMIUM

By P. A. Rydberg

For sixty years a very interesting and rather handsome Chenopodiaceous shrub had borne the name *Grayia*,[1] named in honor of the immortal Asa Gray. In December, 1900, Dr. E. L. Greene replaced it by *Eremosemium*[2] under the plea that the former "dates from 1841 only; while another genus by the same name was published a year or two earlier." It would have been well if Dr. Greene had stated by whom and where this other *Grayia*

[1] Hook. & Arn. Bot. Beechey Voy. 387. 1840.

[2] Greene, Pittonia 4: 225. D 1900.